

UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s)	John M. Belcea	Group Art Unit:	2663
Application No.:	09/996,603	Examiner:	Ngo, Nguyen Hoang
Filed:	November 30, 2001	Confirmation No.	4108
Title:	A SYSTEM AND METHOD FOR COMPUTING THE SIGNAL PROPAGATION TIME AND THE CLOCK CORRECTION FOR MOBILE STATIONS IN A WIRELESS NETWORK		

AMENDMENT

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-145

Sir:

This communication is responsive to the Office Action mailed March 8, 2006, concerning the above-identified application and is timely filed within the three month shortened statutory period for a response. Applicant submits the following Amendment and Remarks and respectfully requests the Examiner to reconsider the rejections made in the Action and to allow the claims to issue.

Please amend the application as follows:

Amendments to the Claims are reflected in the listing of claims, which begins on page 2 of this paper.

Remarks/Arguments begin on page 9 of this paper.

AMENDMENT TO THE CLAIMS

This listing of claims will replace all prior versions, and listing, of claims in the application.

Listing of Claims:

1. (Original) A method for determining a relationship between the timing of a local clock of a node with respect to the timing of a local clock of at least one other node in a wireless communications network, comprising:

transmitting a clock information request message from said node to said other node at a request transmission time;

receiving at said node a response message from said other node at a response reception time, said response message including timing information pertaining to a request reception time at which said other node received said clock information request message and response transmission time at which said other node transmitted said response message; and

calculating a difference between the timing of said local clock of said node and said local clock of said other node based on said timing information, said request transmission time and said response reception time.

2. (Original) A method as claimed in claim 1, further comprising:

calculating a propagation time for a signal to propagate between said node and said other node based on said timing information, said request transmission time and said response reception time.

3. (Original) A method as claimed in claim 1, wherein:

said request transmission time and said response reception time are indicated by said local clock of said node, and said request reception time and said response transmission time are indicated by said local clock of said other node.

4. (Original) A method as claimed in claim 1, wherein:

said method performs said transmitting, receiving and calculating steps to calculate a respective said difference between the timing of said local clock of said node and a respective said local clock of each of a plurality of said other nodes.

5. (Original) A method as claimed in claim 4, further comprising:

calculating respective said differences between the timing of respective said local clocks of each of said plurality of other nodes and each other based on said difference between said respective differences between the timing of said local clock of said node and said respective local clocks of said plurality of other nodes.

6. (previously presented) A method as claimed in claim 1, wherein:

said network includes an ad-hoc multihopping communications network, and said node and said other nodes are adapted for use with said ad-hoc multihopping communications network.

7. (Original) A method as claimed in claim 1, wherein:

said node is a mobile node.

8. (Original) A method as claimed in claim 1, wherein:

said other node is a mobile node.

9. (currently amended) A method ~~as claimed in claim 1~~ for determining a relationship between the timing of a local clock of a node with respect to the timing of a local clock of at least one other node in a wireless communications network, comprising:

transmitting a clock information request message from said node to said other node at a request transmission time;

receiving at said node a response message from said other node at a response reception time, said response message including timing information pertaining to a request reception time at which said other node received said clock information request message and response transmission time at which said other node transmitted said response message; and

calculating a difference between the timing of said local clock of said node and said local clock of said other node based on said timing information, said request transmission time and said response reception time, further comprising:

controlling said other node to transmit a subsequent signal at a beginning of a time slice;

receiving said subsequent signal at said node;

calculating a subsequent transmission time at which said local clock of said other node was reading when said other node transmitted said subsequent signal based on said calculated difference between the timing of said local clock of said node and said local clock of said other node; and

comparing said subsequent transmission time to a time representing a beginning of a time slice to determine a propagation time for said subsequent signal to propagate between said other node and said node.

10. (Original) A system for determining a relationship between the timing of a local clock of a node with respect to the timing of a local clock of at least one other node in a wireless communications network, said system comprising:

a transmitter, adapted to transmit a clock information request message from said node to said other node at a request transmission time;

a receiver, adapted to receive at said node a response message from said other node at a response reception time, said response message including timing information pertaining to a request reception time at which said other node received said clock information request message and response transmission time at which said other node transmitted said response message; and

a processor, adapted to calculate a difference between the timing of said local clock of said node and said local clock of said other node based on said timing information, said request transmission time and said response reception time.

11. (Original) A system as claimed in claim 10, wherein:

said processor is further adapted to calculate a propagation time for a signal to propagate between said node and said other node based on said timing information, said request transmission time and said response reception time.

12. (Original) A system as claimed in claim 10, wherein:

said request transmission time and said response reception time are indicated by said local clock of said node, and said request reception time and said response transmission time are indicated by said local clock of said other node.

13. (Original) A system as claimed in claim 10, wherein:

said transmitter, receiver and processor perform said transmitting, receiving and calculating, respectively, to calculate a respective said difference between the timing of said local clock of said node and a respective said local clock of each of a plurality of said other nodes.

14. (Original) A system as claimed in claim 13, wherein:

said processor is further adapted to calculate respective said differences between the timing of respective said local clocks of each of said plurality of other nodes and each other based on said difference between said respective differences between the timing of said local clock of said node and said respective local clocks of said plurality of other nodes.

15. (previously presented) A system as claimed in claim 10, wherein:

said network includes an ad-hoc multihopping communications network, and said node and said other nodes are adapted for use with said ad-hoc multihopping communications network.

16. (Original) A system as claimed in claim 10, wherein:

said node is a mobile node.

17. (Original) A system as claimed in claim 10, wherein:

said other node is a mobile node.

18. (currently amended) A system ~~as claimed in claim 10~~, for determining a relationship between the timing of a local clock of a node with respect to the timing of a local clock of at least one other node in a wireless communications network, said system comprising:

a transmitter, adapted to transmit a clock information request message from said node to said other node at a request transmission time;

a receiver, adapted to receive at said node a response message from said other node at a response reception time, said response message including timing information pertaining to a request reception time at which said other node received said clock information request message and response transmission time at which said other node transmitted said response message; and

a processor, adapted to calculate a difference between the timing of said local clock of said node and said local clock of said other node based on said timing information, said request transmission time and said response reception time, further comprising:

a controller, adapted to control said other node to transmit a subsequent signal at a beginning of a time slice; and

wherein:

said receiver is adapted to receive said subsequent signal at said node; and

said processor is adapted to calculate a subsequent transmission time at which said local clock of said other node was reading when said other node transmitted said subsequent signal based on said calculated difference between the timing of said local clock of said node and said local clock of said other node, and to compare said subsequent transmission time to a time representing a beginning of a time slice to determine a propagation time for said subsequent signal to propagate between said other node and said node.

REMARKS/ARGUMENTS

In response to the office action dated March 8, 2006, Claims 9 and 18 have been amended. Claims 1-18 remain pending in this application.

Submitted herewith are two (2) sheets of formal drawings (replacement sheets), Figures 1 through 3 for the above-identified application.

Applicant respectfully request that the Docket Number in this application be changed to read: MESH029.

Allowable subject matter

Applicants acknowledge the allowability of claims 9 and 18 once amended to overcome the objection set forth in the Office Action by being rewritten in independent form including all of the limitations of the base claim. Applicants have so amended these claims.

Rejection of Claims 1-5 and 10-14 under 35 U.S.C. §102(b) as anticipated by Mincher et al (US 5,408,506):

The rejection of Claims 1-5 and 10-14 under 35 U.S.C. §102(b) as anticipated by Mincher et al (US 5,408,506) is respectfully traversed and reconsideration and withdrawal of the rejection is respectfully requested at this time.

Mincher et al (US 5,408,506) describes a method for implementing distributed time synchronization in a wireless network using frequency hopping spread spectrum (FHSS). The nodes of a network operating in FHSS mode must have their clock synchronized in order to perform frequency switching in the same time for being able to maintain communication. The term “same time” is somewhat relative, as it is impossible to synchronize two clocks with infinite precision or absolute zero error. Mincher identifies this problem and marks a “dead time” (Fig. 8 and col. 11 line 5) when no communication is possible while the nodes are in transition from one frequency to another and the transition does not happen in exactly the same moment in all nodes, due to systematic and random errors.

According with Mincher’s method, a node transmits a message and the transmission time, measured with the local clock. The receiving node receives the message, measures the Time Of

Arrival of the message, makes a difference between the time registered in the message and the time of arrival of the message and applies a correction to its clock. Mincher suggests correcting the clock with the average of clock errors measured from messages received from all neighbors.

Applicant respectfully submits that the Mincher method does not make any presumption about the time needed for propagating of the radio signal between nodes in the network. When a node synchronizes its clock on the received signal, the clock is behind the other clock with at least the propagation time (supposing that no other errors are involved). Applicant's present invention, as claimed, is oriented towards identifying and measuring the propagation time of the signal between neighbors that Mincher considers implicitly as zero. Since the information used in Applicant's present invention for computing the distance between neighbors can be used also for synchronizing the terminal clocks, it is utilized. It is only because the information is already available.

For better understanding of the problem, let suppose a network with two nodes A, B. In the Mincher method, node B synchronizes on the signal received from A. When B transmits, A will identify that its clock is behind of the received signal. The delay at terminal A is in fact twice the signal propagation time. Using Applicant's invention, node A and B exchange messages and from information carried in those messages they compute the signal propagation time and the clock corrections. In other words, in applicant's method, the clocks at both nodes tick in the same time and messages received by each node are behind the clock tick with exactly the signal propagation time (supposing the measurements of Time Of Arrival are not affected by errors).

Regarding the rejection of claims 1, 5, 10 and 14

Applicant respectfully submits that Mincher et al (US 5,408,506) does not anticipate the invention recited in Claims 1, 5, 10 and 14. Applicant agrees with the Examiner that Mincher presents a method and system for synchronizing the nodes in a network, however, Applicant respectfully disagrees with the remainder of the Examiner's equating of Mincher's invent to Applicant's present invention as claimed in Claims 1,5, 10, and 14.

More specifically, Applicant respectfully submits that Mincher does not anticipate nor make obvious a reply including the time when the station has received the request. Further, the Mincher method requires only one message, the reply being optional.

Applicant respectfully disagrees with the Examiner's characterization of col 8 lines 53-55 for extending the capabilities of the Mincher method. Applicant respectfully submits that the quoted text shows that a node joining the network transmits a special message that informs the neighbors not to use the TOA of its messages for synchronization purposes as it is not synchronized yet to the network. Applicant refers the Examiner to the whole paragraph (col 8 lines 47-59) in order to understand the meaning of Fig. 5.- Flowchart of a preferred method for a node joining an existing wireless network. The examiner characterizes col. 10 lines 4-6 and col. 10 lines 27-28 of Mincher as specifying transmitting a reply message and the message containing "timing information pertaining to a request reception time". Applicant respectfully submits that nowhere in the description does Mincher describe nor anticipate transmitting any information regarding the reception time (TOA), but only information regarding the transmission time of the message.

Applicant respectfully disagrees with the examiner's characterization that Mincher uses the same equation as utilized in Applicant's present invention. In contrast, Mincher's equation has three terms (col. 11 line 49), while Applicant's invention has 4 terms (see in [0028] the equation of propagation time p and the equation of clock difference dAB). The examiner calls one of these terms "Txmin (timing information)". In col 11 line 53 Mincher said: "Txmin is the time interval required for message transmission and storage in RAM 36." Applicant respectfully submits that the Examiner's characterization is inaccurate, as transmission and storage are not part of the same processing sequence. In this term, Mincher appears to be including processing delays which are not related to Applicant's invention.

Therefore, since claims 1, 5, 10 and 14 include subject matter which constitutes patentable subject matter, Applicants respectfully submit that claims 1, 5, 10 and 14 are in proper condition for allowance and request that claims 1, 5, 10 and 14 may now be passed to allowance.

Regarding the rejection of claims 2 and 11

Applicant respectfully submits that Mincher et al (US 5,408,506) does not anticipate the invention recited in Claims 2 and 11. Applicants submit that claims 2 and 11 are allowable over the cited references based on their dependencies upon amended claims 1 and 10 respectively, which claims were shown to be allowable above. In addition, Applicants submit that claims 2

and 11 are independently patentable because they include limitations not taught or suggested by the cited references.

The examiner rejects claims 2 and 11 stating that Mincher is using a “time difference (correlating to propagation time).” As explained previously herein, Mincher does not consider “signal propagation” as an important element affecting synchronization, as it is too small to affect his targeted precision. Applicant’s present invention is about measuring the signal propagation time.

Therefore, since claims 2 and 11 introduce additional subject matter that, particularly when considered in the context of the recitations of amended claims 1 and 10, constitutes patentable subject matter, Applicants respectfully submit that claims 2 and 11 are in proper condition for allowance and request that claims 2 and 11 may now be passed to allowance.

Regarding the rejection of claims 3 and 12

Applicant respectfully submits that Mincher et al (US 5,408,506) does not anticipate the invention recited in Claims 3 and 12. Applicants submit that claims 3 and 12 are allowable over the cited references based on their dependencies upon amended claims 1 and 10 respectively, which claims were shown to be allowable above. In addition, Applicants submit that claims 3 and 12 are independently patentable because they include limitations not taught or suggested by the cited references.

Claims 3 and 12 recite that the transmission time of the request and the transmission time of the replay are measured with the local clocks. The examiner rejects the claims as being disclosed by Mincher in col 12 lines 20-27. Although Applicant agrees with the Examiner that the Mincher transmits a request message and receives reply messages, Applicant respectfully submits that (a) Mincher’s reason for transmitting the request message is different from Applicant’s invention, (b) the content of the request message in Mincher is different than Applicant’s invention, (c) the content of the reply messages in Mincher is different than Applicant’s invention; and (d) the elements computed from the received information in Mincher is different from Applicant’s invention.

Therefore, since claims 3 and 12 introduce additional subject matter that, particularly when considered in the context of the recitations of amended claims 1 and 10, constitutes

patentable subject matter, Applicants respectfully submit that claims 3 and 12 are in proper condition for allowance and request that claims 3 and 12 may now be passed to allowance.

Regarding the rejection of claims 4 and 13

Applicant respectfully submits that Mincher et al (US 5,408,506) does not anticipate the invention recited in Claims 4 and 13. Applicants submit that claims 4 and 13 are allowable over the cited references based on their dependencies upon amended claims 1 and 10 respectively, which claims were shown to be allowable above. In addition, Applicants submit that claims 4 and 13 are independently patentable because they include limitations not taught or suggested by the cited references.

Claims 4 and 13 describe the method of transmitting, receiving and calculating. Although Applicant agrees with the Examiner that Mincher discloses the same steps, Applicant respectfully submits that the elements that are subject of transmitting, receiving and calculating are different in Mincher than Applicant's invention.

Therefore, since claims 4 and 13 introduce additional subject matter that, particularly when considered in the context of the recitations of amended claims 1 and 10, constitutes patentable subject matter, Applicants respectfully submit that claims 4 and 13 are in proper condition for allowance and request that claims 4 and 13 may now be passed to allowance.

Rejection of Claims 6, 7, 8, 15, 16, and 17 under 35 U.S.C. §103(a) as being unpatentable over Mincher et al (US 5,408,506) in view of Haartsen (US 6,754,250):

The rejection of Claims 6, 7, 8, 15, 16, and 17 under 35 U.S.C. §103(a) as being unpatentable over Mincher et al (US 5,408,506) in view of Haartsen (US 6,754,250) is respectfully traversed and reconsideration and withdrawal of the rejection is respectfully requested at this time.

The applicant submits that claims 6,7,8,15,16, and 17 are allowable over the cited references based on their dependencies upon amended claims 1 and 10 respectively, which claims were shown to be allowable above. In addition, Applicant submits that claims 6,7,8,15,16, and 17 are independently patentable because they include limitations not taught or suggested by the cited references. Specifically, Applicant respectfully submits that "multihopping" as used in Applicant's invention is not the same as "frequency hopping".

Therefore, since claims 6,7,8,15,16, and 17 introduce additional subject matter that, particularly when considered in the context of the recitations of amended claims 1 and 10, constitutes patentable subject matter, Applicants respectfully submit that claims 6,7,8,15,16, and 17 are in proper condition for allowance and request that claims 6,7,8,15,16, and 17 may now be passed to allowance.

The other references of record have been reviewed and applicant's invention is deemed patentably distinct and nonobvious over each taken alone or in combination.

For the foregoing reasons, applicants respectfully request that the above rejections be withdrawn.

No amendment made was related to the statutory requirements of patentability unless expressly stated herein. No amendment made was for the purpose of narrowing the scope of any claim, unless Applicant has argued herein that such amendment was made to distinguish over a particular reference or combination of references.

The Applicants believe that the subject application, as amended, is in condition for allowance. Such action is earnestly solicited by the Applicants.

In the event that the Examiner deems the present application non-allowable, it is requested that the Examiner telephone the Applicant's attorney or agent at the number indicated below so that the prosecution of the present case may be advanced by the clarification of any continuing rejection.

The Commissioner is hereby authorized to charge Deposit Account 502117, Motorola, Inc, with any fees which may be required in the prosecution of this application.

Respectfully submitted,

May 31, 2006

Motorola, Inc.
8000 West Sunrise Boulevard
Law Department – MD1610
Plantation, Florida 33322
Customer Number: 24273

By: /Randi L. Karpinia/
Randi L. Karpinia
Attorney of Record
Reg. No.: 46,148
Tel: 954-723-6449
Fax: 954-723-3871
E-Mail: docketing.florida@motorola.com